E951 POWER SUPPLY
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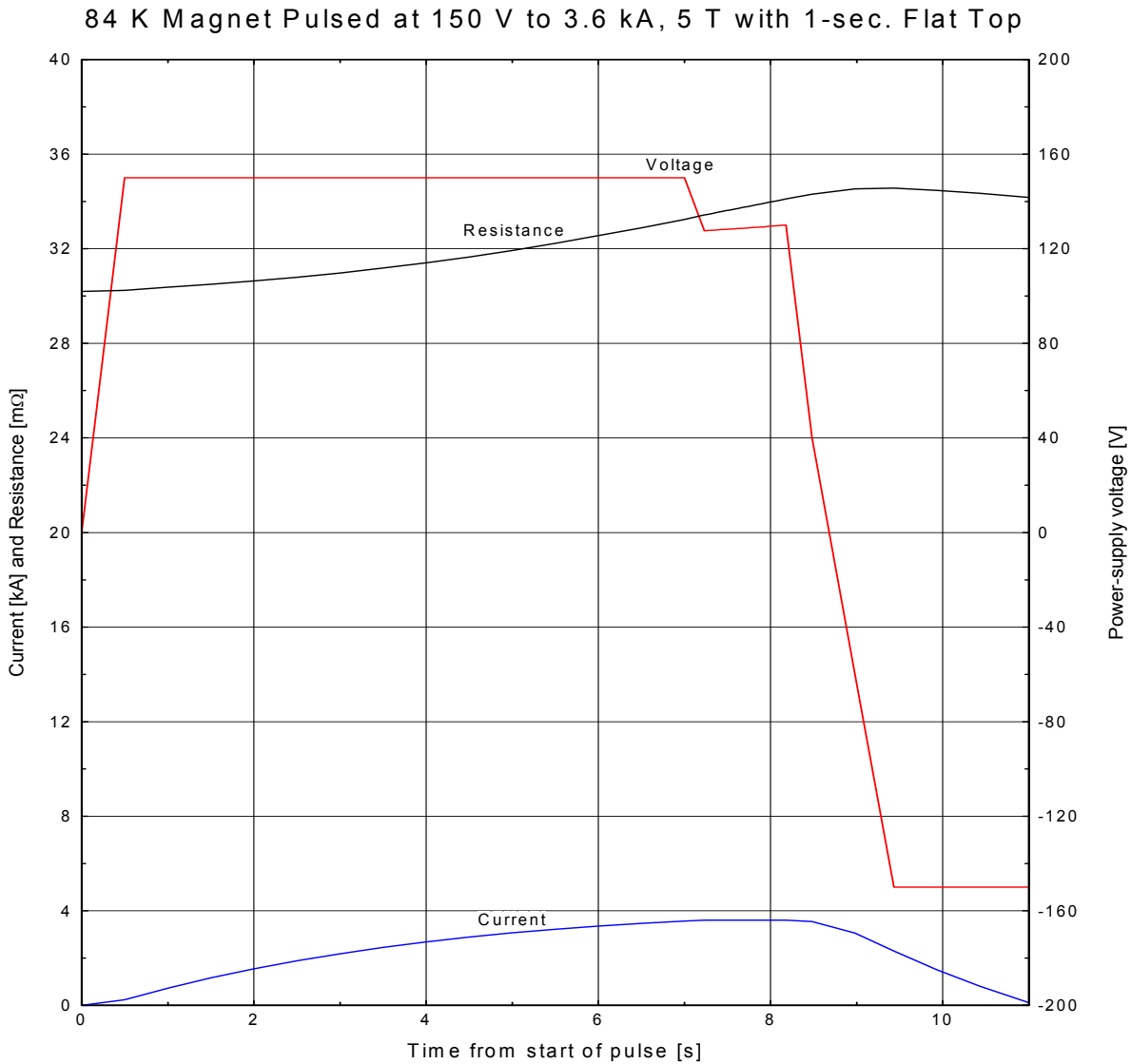
Project Goals

- The project goal is to pulse a magnet with 20 cm diameter bore, capable of a peak field near 15 T and a repetition rate of about 30 minutes.
- Complete the design of the power supply design/modifications by the end of FY 02
- Complete the fabrication of the power supply by the end of the FY03.
- Complete installation and commissioning by the middle of FY04

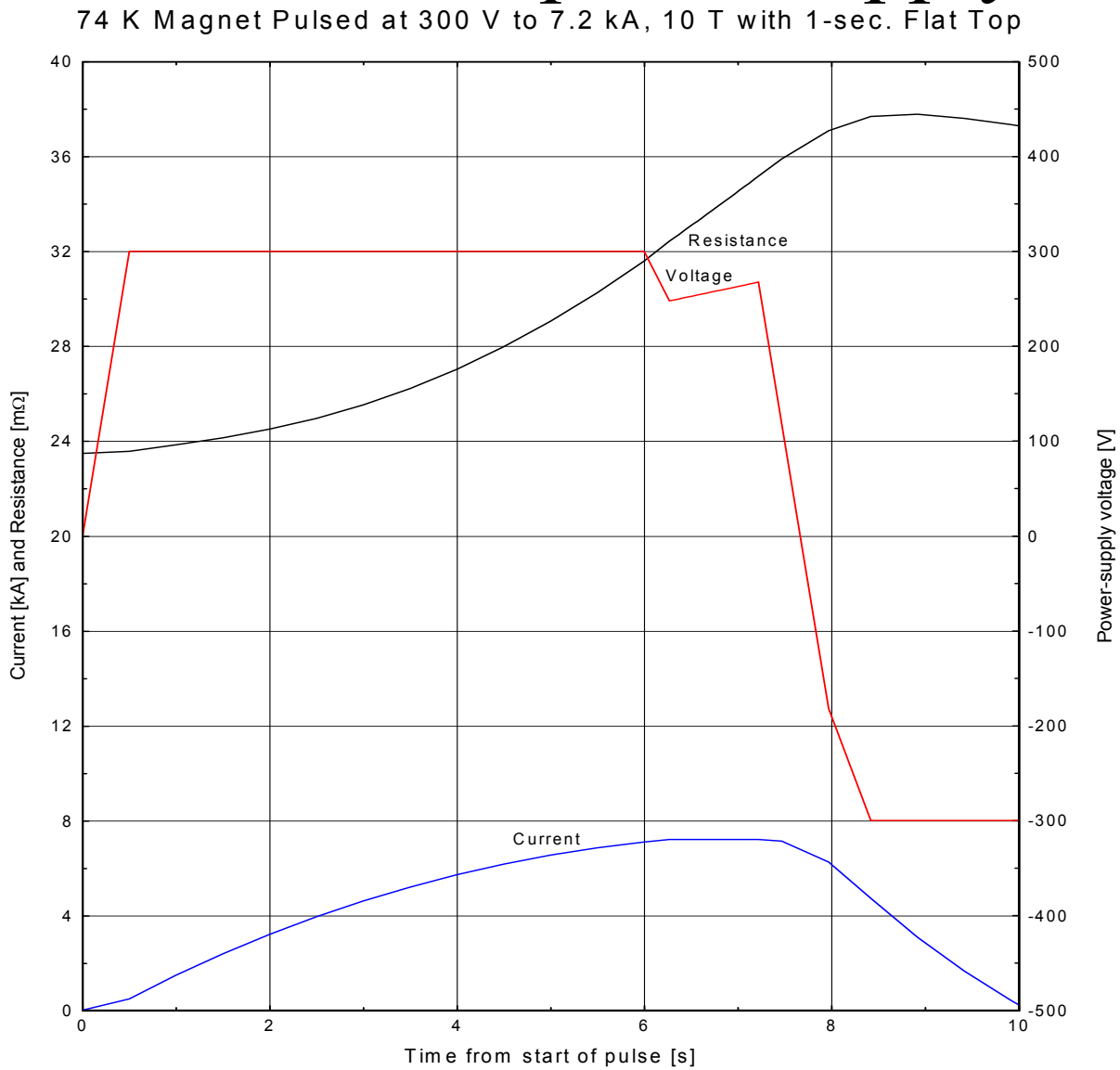
Parameters of the Pulse Magnet System with 1 sec flat top

	Units	Case 1	Case 2	Case 3
Outer radius	(cm)	30.0	30.0	40.0
Copper mass	(kg)	1943	1943	3644
Voltage	(V)	150	300	300
Peak current	(A)	3600	7200	7200
Field	(T)	5.0	10.0	14.5
Inductance	(mH)	138	138	436
Initial temperature	(K)	84	74	30
Time t1, to end of flat tap	(s)	8.2	7.3	16.3
Pulse length, tp	(s)	11.1	10.1	24.1
Initial Resistance	(mOhms)	30.2	23.5	11.0
Resistance at t1,	(mOhms)	34.1	35.3	33.0
Resistance at tp,	(mOhms)	34.1	37.2	38.2
Dissipation at tp,	(MJ)	2.70	9.1	15.2

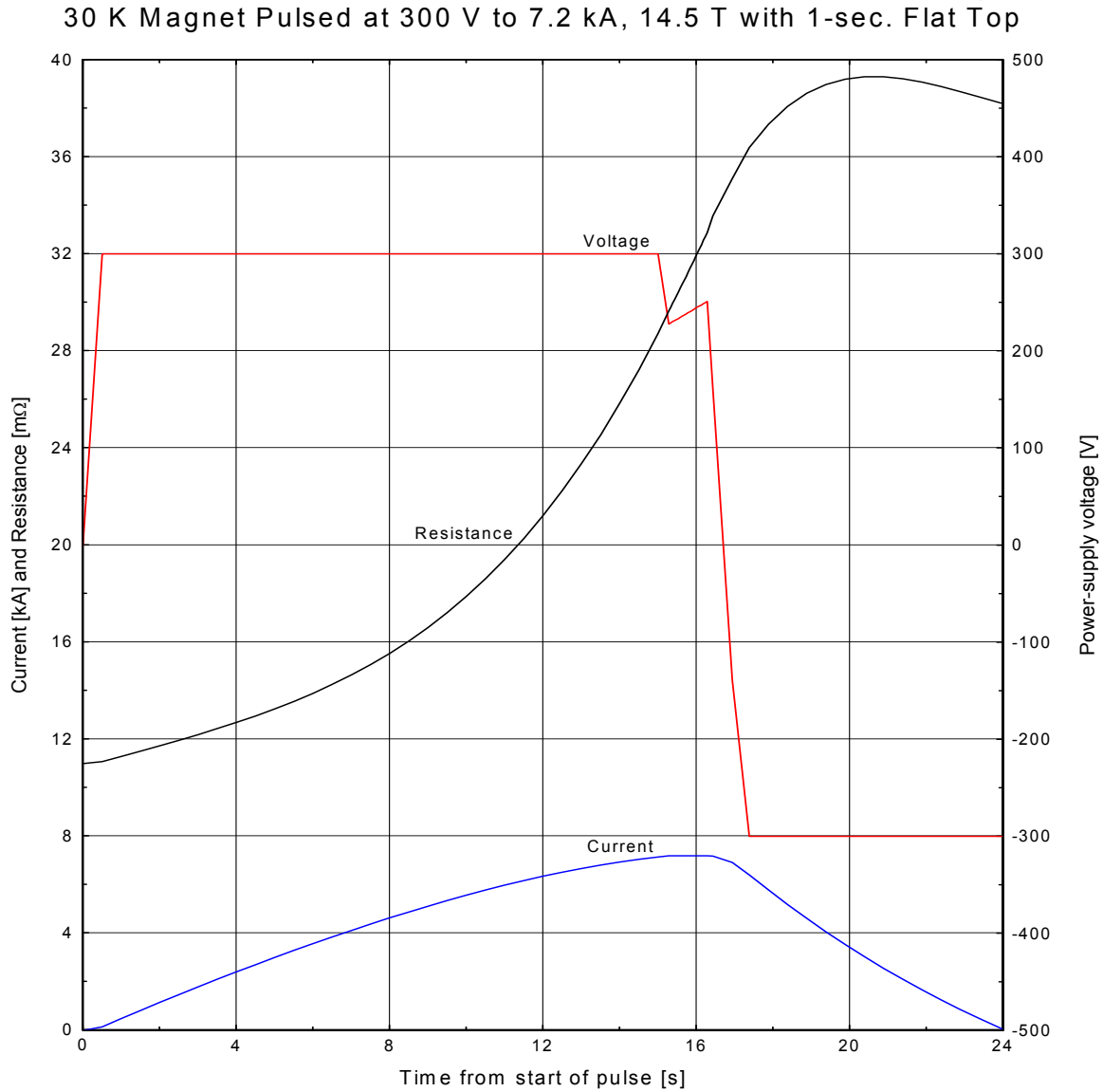
Performance of the 5T magnet with case 1 power supply



Performance of the 10T magnet with case 2,3 power supply



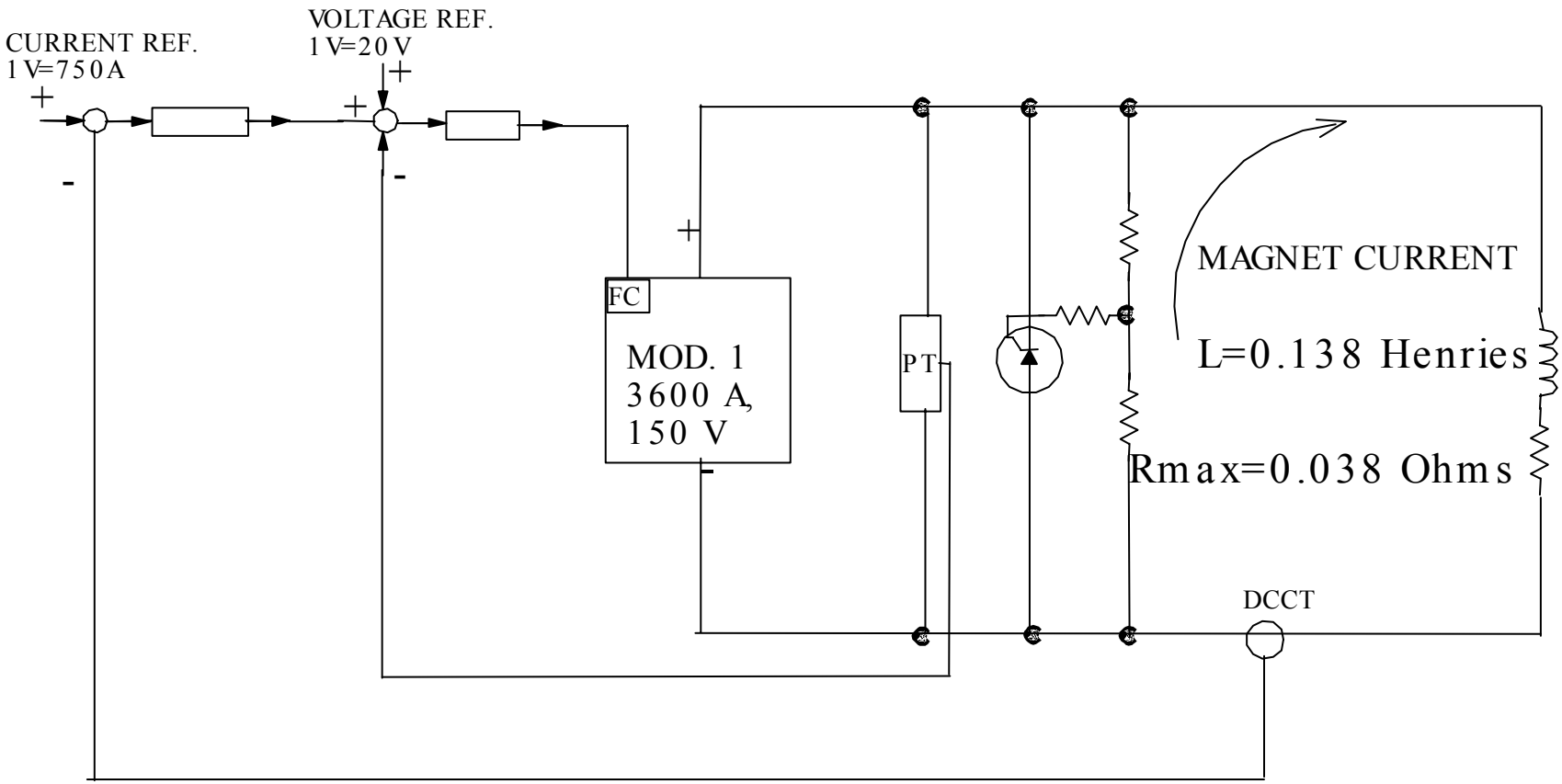
Performance of the 15T magnet with case 2,3 power supply



Case 1 power supply

- 540 KVA power supply rated at 3600 A, +/-150 V
- Thyristor-control six-pulse rectifier, available at Brookhaven Labs from previous experiments. (Model Meeker #431)
- The power supply is presently configured as DC power supply
- We need a new regulator to be able to pulse it, based on the existing design for the AGS Main magnet power supply.
- The controls and interlocks of the power supply must be updated.
- New direct current potential transformer (DCPT).
- New crow bar circuit to absorb magnet stored energy.
- Similar upgrades have been made during the Booster project with great success.

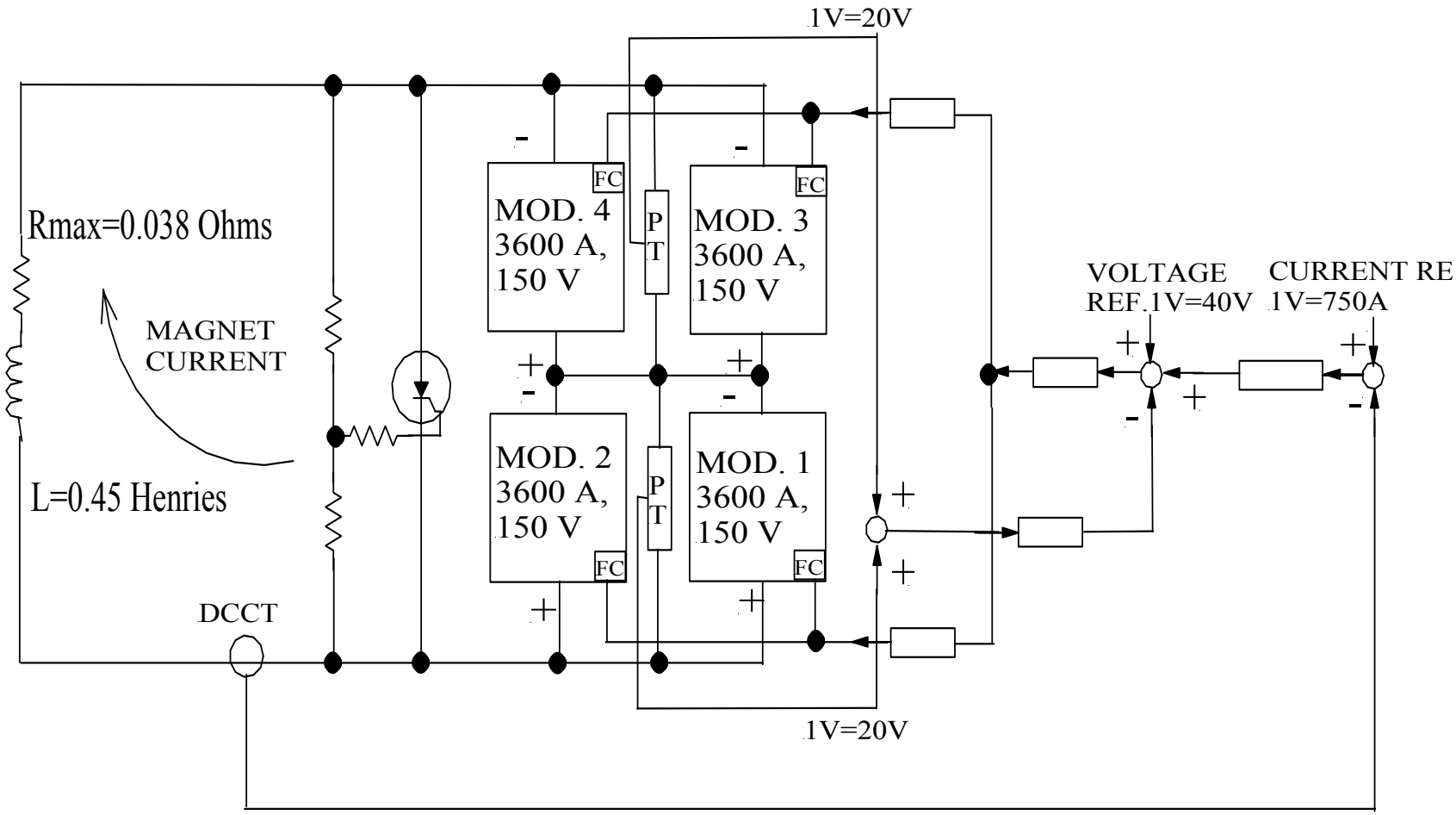
Case 1 power supply regulator



Case 2,3 power supply

- Four series parallel, 540 KVA power supplies rated at 3600 A, +/-150 V each, Total rating 7200A, +/-300V.
- Thyristor-control six-pulse rectifiers, available at Brookhaven Labs from previous experiments. (Model Meeker #431, in parallel with # 433, and #429, in parallel with # 432,)
- The power supplies are presently configured as DC power supplies.
- We need a new regulator to be able to pulse it,based on the existing design for the AGS Main magnet power supply.
- The controls and interlocks of the power supply must be updated.
- New direct current potential transformer (DCPT).
- New direct current current transformer (DCCT).
- New crow bar circuit to absorb magnet stored energy.
- Similar upgrades have been made during the Booster project with great success.

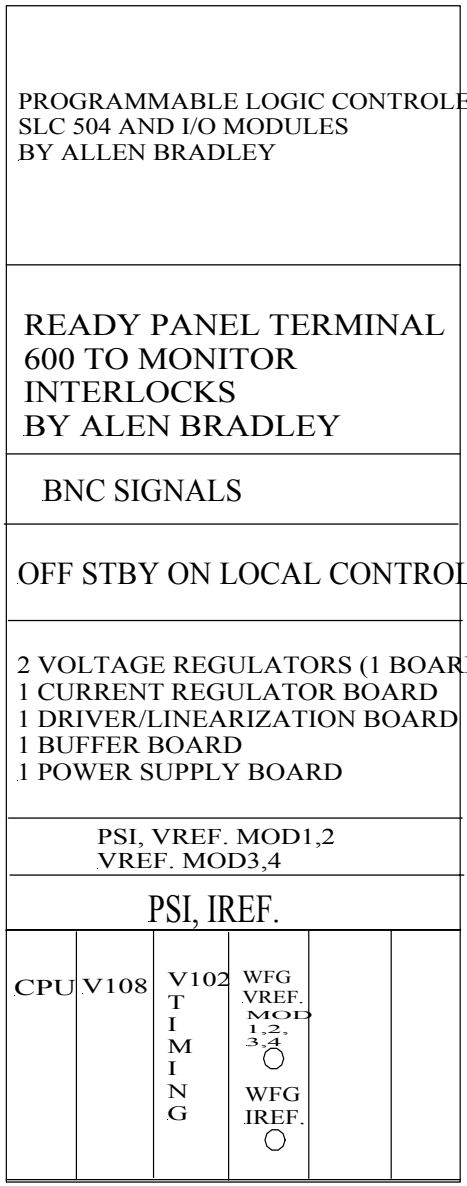
Case 2,3 power supply regulator



More power supply details

- The 3-phase, 480-V input power will be fed from existing disconnect switches.
- The power supply will have four AC circuit breakers, one per power supply.(Note #429 and # 432 currently do not have AC breakers)
- Two parallel power supplies (MOD 1 and MOD 2) will be fed from the same existing substation and the other two (MOD 3 and MOD 4) from a different existing substation.
- The power supply will be fully programmable from 0 to 7200A. It will have two voltage regulators as the inner loops and a current regulator as the outer loop.
- The anticipated overall bus resistance should not exceed 2 mΩ.
- All the old interlocks will be updated using an Allen Bradley Programmable Logic Controller (PLC).
- Minimum repetition rate for case1 magnet is 5 minutes, for case 2 magnet is 20 minutes, for case 3 magnet 30 minutes.

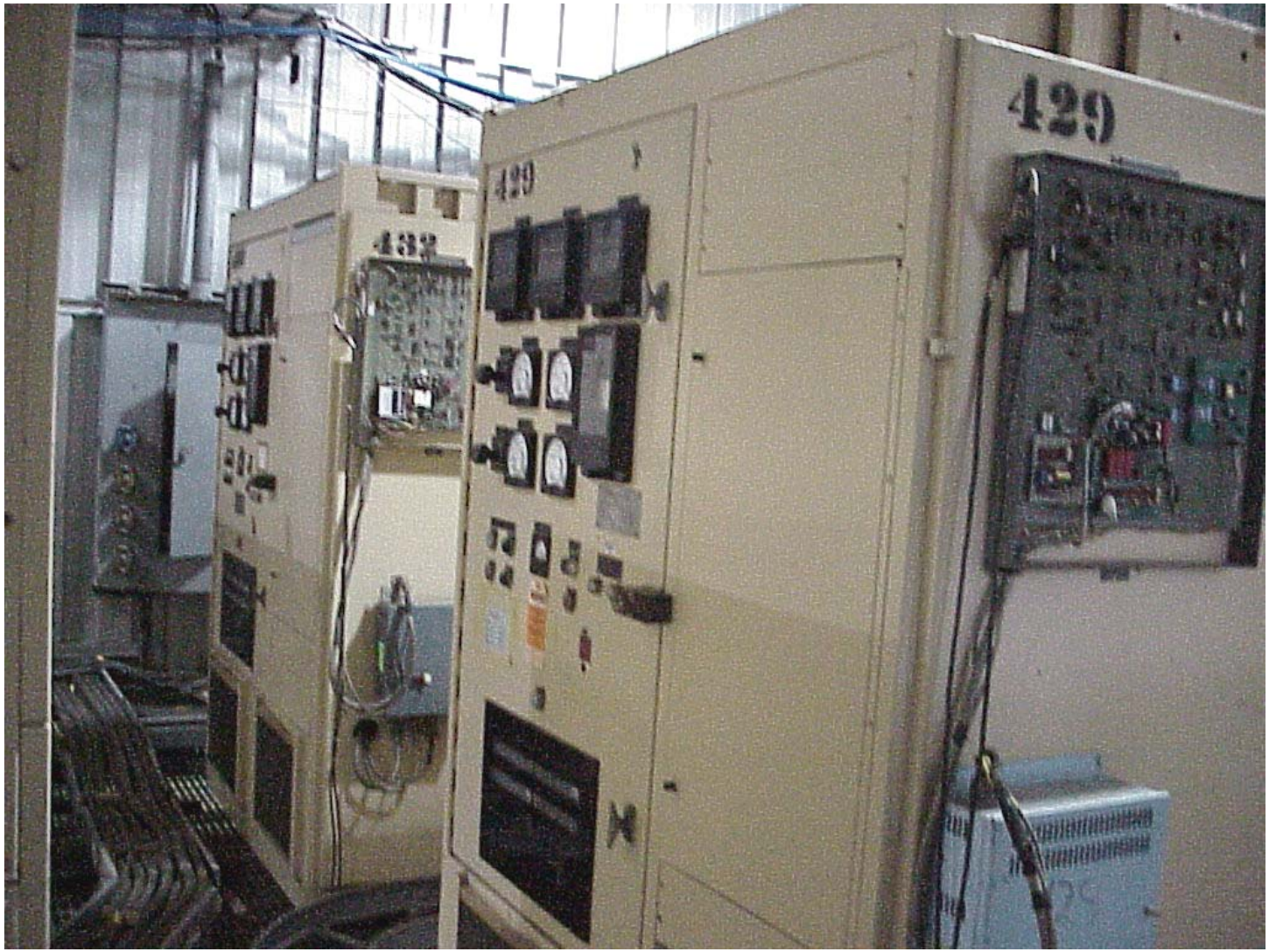
Controls rack lay out



Power supply interlocks

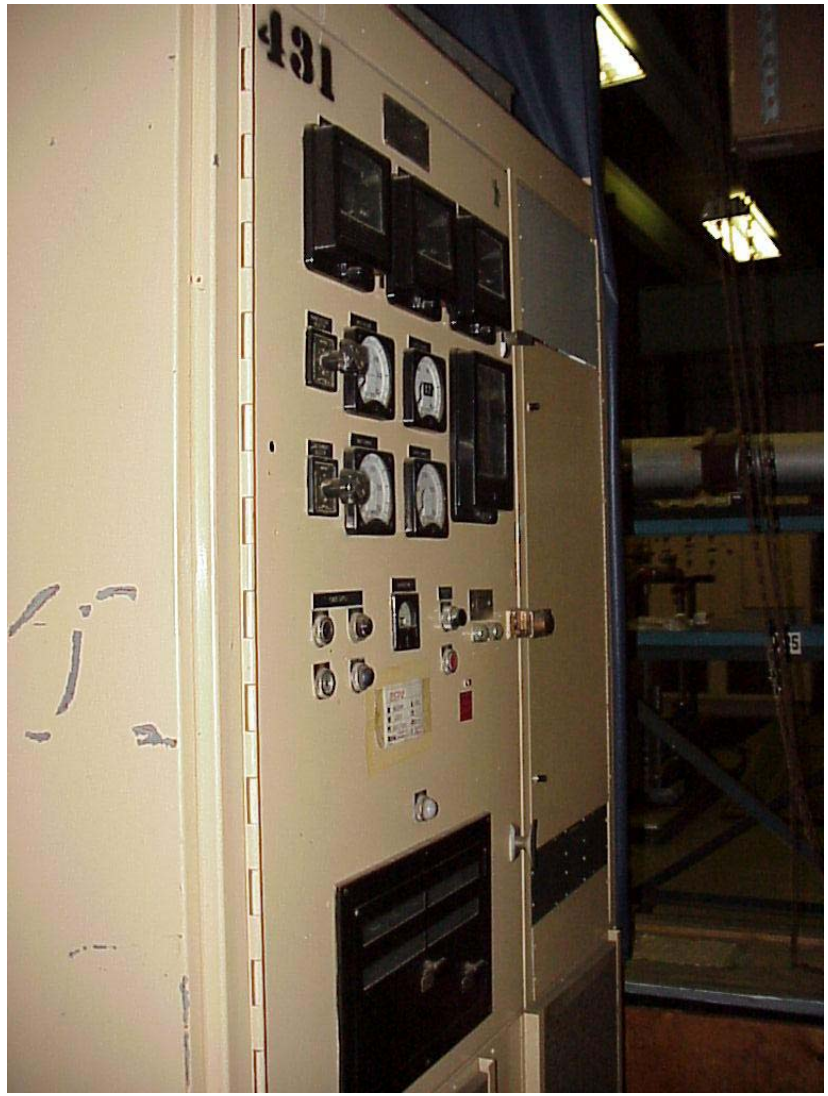
- DC Over-current
- RMS magnet current interlock
- AC Over current
- Blower failure
- Ground Fault
- Magnet faults
- Magnet resistance interlock.
- Cryo-interlocks
- Doors are open
- SCR over-temperature
- SCR failure
- Power supply cubicle over-temperature
- Soft start over load

Power supplies picture 1



Power supplies picture 2

Power supplies picture 3



Power supplies picture 4

Current Status

- Regulator design 70% done.
- PLC Interlock design 70% done.
- Local controls design 70% done.
- Remote control design 60% done.
- Crow bar circuit design 50% done.
- Power supply lay out design 60% done.
- DC buss lay out design 0% done.
- AC power design 0% done.
- DCPT Specified 100% done.(LEM CV-500, LEM CV-350)
- DCCT Specified 50% done.
- Power supply schematics 100% done.

Related Documents

- Regulator chassis drawing marked up.
- Voltage regulator drawing marked up.
- Current regulator drawing marked up.
- Regulator driver/linearization board marked up.
- Power supply schematic diagram.
- Power supply PLC controls/interlocks diagram.